

HP Smart Array Multipath Software User Guide



October 2003 (Third Edition)
Part Number 307958-003

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About This Guide

This guide provides installation and troubleshooting procedures for the Smart Array Multipath software for the HP StorageWorks Modular Smart Array 500 system.

Audience Assumptions

This guide is for the person who installs, administers, and troubleshoots servers and storage systems. HP assumes you are qualified in the servicing of computer equipment and trained in recognizing hazards in products with hazardous energy levels.

Important Safety Information

Before installing this product, read the *Important Safety Information* document included with the server.

Symbols in Text

These symbols may be found in the text of this guide. They have the following meanings.



WARNING: Text set off in this manner indicates that failure to follow directions in the warning could result in bodily harm or loss of life.



CAUTION: Text set off in this manner indicates that failure to follow directions could result in damage to equipment or loss of information.

IMPORTANT: Text set off in this manner presents essential information to explain a concept or complete a task.

NOTE: Text set off in this manner presents additional information to emphasize or supplement important points of the main text.

Related Documents

For additional information on the topics covered in this guide, refer to the following documentation:

- *HP StorageWorks Modular Smart Array 500 System User Guide*
- *HP StorageWorks Modular Smart Array 500 System Hardware Configuration and Installation poster*
- *4-Port Shared Storage Module Installation Instructions*
- *HP Array Configuration Utility User Guide*

Getting Help

If you have a problem and have exhausted the information in this guide, you can get further information and other help in the following locations.

Technical Support

In North America, call the HP Technical Support Phone Center at 1-800-652-6672. This service is available 24 hours a day, 7 days a week. For continuous quality improvement, calls may be recorded or monitored. Outside North America, call the nearest HP Technical Support Phone Center. Telephone numbers for worldwide Technical Support Centers are listed on the HP website, www.hp.com.

Be sure to have the following information available before you call HP:

- Technical support registration number (if applicable)
- Product serial number
- Product model name and number
- Applicable error messages
- Add-on boards or hardware
- Third-party hardware or software
- Operating system type and revision level

HP Website

The HP website has information on this product as well as the latest drivers and flash ROM images. You can access the HP website at www.hp.com.

Authorized Reseller

For the name of the nearest authorized reseller:

- In the United States, call 1-800-345-1518.
- In Canada, call 1-800-263-5868.
- Elsewhere, see the HP website for locations and telephone numbers.

Reader's Comments

HP welcomes your comments on this guide. Please send your comments and suggestions by e-mail to ServerDocumentation@hp.com.

System Preparation

Overview

Smart Array Multipath software delivers dual path functionality and supports failover capability for redundant host bus adapters (HBAs) in a server with redundant cabling to an HP StorageWorks Modular Smart Array 500 system. This fault-tolerant tool enhances availability in clustering and direct attached storage (DAS) solutions with up to two servers managing up to 2 TB of stored data.

The software supports multiple I/O paths to the same logical volumes. When a path fails, the software moves the logical drives from the failed path to the path of the redundant HBA in the same server.

Smart Array Multipath software works differently with Microsoft and Linux products to provide specific features that are compatible with operating system functionality.

Minimum Requirements

Be sure that your solution consists of the following hardware:

- At least one server with two supported HBAs (Smart Array 5i, 5i+, or 532 controllers) with updated firmware
- A supported operating system installed on the server or MSA500 system

- An MSA500 system with the following:
 - At least one HP StorageWorks Modular Smart Array 500 controller
 - A 2-Port Shared Storage Module and two SCSI cablesor
 - A 4-Port Shared Storage Module and four SCSI cables

For the latest versions of firmware, refer to
www.hp.com

Supported Operating Systems

Supported operating systems include:

- Microsoft®
 - Windows® 2000
 - Windows Server 2003

IMPORTANT: Systems running Microsoft Windows 2000 with Service Pack 4 or Windows Server 2003 must use Smart Array Multipath Software v2.0 or later.

- Linux
 - Red Hat
 - SuSE Linux Enterprise Server (SLES)
 - UnitedLinux

IMPORTANT: Systems running UnitedLinux v1.0 must:

- Use Service Packs 1 and 2
- Use Smart Array Multipath Software v2.0 or later.

For the most current operating system support information, refer to
www.hp.com/products/sharedstorage

Microsoft Feature Support

Features supported under Microsoft operating systems include:

- Static LUN balancing enables the administrator to optimize I/O by assigning specific volumes to specific paths in the storage system. If one path fails, the system moves volumes to the path for the redundant HBA for I/O management.
- Server-based PCI Hot Plug functionality supports online HBA addition and replacement
- Logical volume hot-add functionality supports online array expansion/extension
- ProLiant Storage Manager software and device manager extension provide point-and-click multipath management.
- Configuration flexibility enables boot volumes for DAS solutions to reside on the storage system.

Linux Feature Support

Features supported under Linux operating systems include:

- Static load (read-only) balancing enables the HBAs to optimize I/O with dual paths to the same volumes in the storage system. If one HBA fails, the system moves volumes to the path for the redundant HBA for I/O management.
- Servers maintain boot volumes and enable greater storage capacity on the storage system.

Multiple Operating System Support

For multipath configurations with multiple operating systems, use Selective Storage Presentation (SSP) to restrict HBAs from accessing logical volumes containing data from a different operating system. For more information about SSP, refer to the documentation that ships with the 4-Port Shared Storage Module.

Supported Four-Node Configurations

The following sections identify supported multipath configurations with their respective 4-Port Shared Storage Module connections and locations for boot and data volumes. These configurations require two or three servers attached with four SCSI cables to the MSA500 system.

Two-Server External Boot Configuration (Microsoft Only)

All boot and data volumes reside on the MSA500 system.

Table 1-1: Two-Server External Boot Configuration (Microsoft Only)

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Storage system	Storage system
	B1		
2	A2	Storage system	Storage system
	B2		

Two-Server Internal Boot Configuration

Boot volumes reside on their respective servers, while data volumes reside on the MSA500 system.

Table 1-2: Two-Server Internal Boot Configuration

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Server 1	Storage system
	B1		
2	A2	Server 2	Storage system
	B2		

Two-Server Mixed Boot Configuration

One boot volume resides on its respective server, while the other boot volume resides on the MSA500 system. Both data volumes reside on the storage system.

Table 1-3: Two-Server Mixed Boot Configuration

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Storage system*	Storage system
	B1		
2	A2	Server 2	Storage system
	B2		

*Linux operating systems support boot volumes on servers only. For a mixed boot configuration in a multiple operating system environment, always locate Linux boot volumes on servers.

Two-Server Cluster Configuration

Identical servers (hardware and software configuration) connect to the MSA500 system. Boot volumes reside on their respective servers, while both data volumes reside on the storage system.

Table 1-4: Two-Server Cluster Configuration

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Server 1	Storage system
	B1		
2	A2	Server 2	Storage system
	B2		

Three-Server External Boot Configuration (Microsoft Only)

All boot and data volumes reside on the MSA500 system. One server connects to two ports.

Table 1-5: Three-Server External Boot Configuration (Microsoft Only)

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Storage system	Storage system
	B1		
2	A2	Storage system	Storage system
3	B2		

Three-Server Internal Boot Configuration

Boot volumes reside on their respective servers, while data volumes reside on the MSA500 system. One server connects to two ports.

Table 1-6: Three-Server Internal Boot Configuration

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Server 1	Storage system
	B1		
2	A2	Server 2	Storage system
3	B2	Server 3	

Three-Server Mixed Boot Configuration

Two boot volume resides on their respective servers, while one boot volume resides on the MSA500 system. All data volumes reside on the storage system. One server connects to two ports.

Table 1-7: Three-Server Mixed Boot Configuration

Server	Port (Bus)	Boot Volume Location	Data Volume Location
1	A1	Storage system*	Storage system
	B1		
2	A2	Server 2	
3	B2	Server 3	

*Linux operating systems support boot volumes on servers only. For a mixed boot configuration in a multiple operating system environment, always locate Linux boot volumes on servers.

Additional Microsoft Preparations

Before installing Smart Array Multipath software on a server with a Microsoft operating system, connect only one of the SCSI cables from one HBA to the MSA500 system. Leave the second SCSI cable to the redundant HBA disconnected. After the multipath software is installed, connect the second SCSI cable.

Additional Red Hat and SuSE Linux Preparations

IMPORTANT: For Red Hat and SuSE operating systems, configure the system for multipath **before** installing the software from the CD. For configuration instructions for UnitedLinux operating systems, refer to Chapter 2, “Installation and Operation.”

Before installing Smart Array Multipath software on a server with a Red Hat or SuSE Linux operating system, perform the following procedures:

- Always edit the active Linux kernel that enables the system to recognize the multipath hardware configuration. Refer to “Editing the Active Linux Kernel” in this chapter.
- Always modify the raidtab configuration file to be sure it contains the appropriate information. Refer to “Modifying the RAIDTAB Configuration File” in this chapter.

Editing the Active Linux Kernel

To configure the system for multipath operations:

1. Modify the *makefile*.
2. Overwrite the active *config* file.
3. Edit the *make config* and make the kernel.
4. Make and install the module.

The procedures in this section provide examples for all these basic steps.

Modifying the Makefile

IMPORTANT: The following procedure is for Red Hat Linux only.

To modify the Makefile:

1. Identify the name of the active kernel:
 - a. At the root level, enter:

```
uname -a
```


- b. Identify the kernel. An example is *2.4.9-e.3enterprise*, where “enterprise” is the name of the kernel. Remember the name for use in later procedures.
2. Use an editor to modify the *Makefile*. For example, enter:

```
vi Makefile
```
3. In the **EXTRAVERSION** field, replace the current value (typically *-e.3custom*) by entering:

```
-e.3enterprise
```

using the name of your kernel in place of “enterprise.”

Overwriting the Active .Config File

Depending on the operating system, use the procedures below.

IMPORTANT: Before overwriting any file, create a backup of the original file.

Red Hat Operating Systems

To overwrite the active .config file for Red Hat operating systems:

1. Locate the specific .config file for the modified kernel:
 - a. From the root level, enter:

```
cd configs
```
 - b. Identify the appropriate .config file by name, for example

```
2.4.9-i686-enterprise.config
```
2. Copy the kernel to the root level directory and overwrite the active .config file.
Enter:

```
cp kernel-2.4.9-i686-enterprise.config ../.config
```
3. When prompted to overwrite the existing file, enter:

```
y
```

SLES 7 Operating System

To overwrite the active .config file for the SLES 7 operating system:

1. Locate the specific .config file for the modified kernel:
 - a. From the root level, enter:

```
cd /boot
```
 - b. Identify the appropriate .config file by name, for example

```
vmlinuz.config
```
2. Copy the kernel to the root level directory and overwrite the active .config file. Enter:

```
cp vmlinuz.config /usr/src/linux/arch/i386
```
3. Go to the root directory. Enter:

```
cd /usr/src/linux/arch/i386
```
4. Save the current config.in file in the current directory to a backup filename.
5. Copy the new .config file and overwrite the config.in file. Enter:

```
cp vmlinuz.config config.in
```
6. When prompted to overwrite the existing file, enter:

```
y
```

Editing the Makeconfig File and Making the Kernel

To edit the *Makeconfig* file:

1. Open the configuration menu. Enter:

```
make menuconfig
```
2. Select **Multi-device support (RAID and LVM)**.
3. Select **RAID support**.
4. Be sure that the **RAID support** option is checked with an asterisk. If it is not checked, use the space bar to cycle through the settings until an asterisk appears next to the option.
5. Select **Multipath I/O support**.

6. Be sure that the **Multipath I/O support** option is set as a module. If it is not set as a module, use the space bar to cycle through the settings until an “M” appears next to the option.
7. Press the **Esc** key twice to exit the menus.
8. When prompted to save the new kernel configuration, press the **Enter** key to select **Yes**.
9. Make the kernel:
 - a. From the root level, enter:
`make`
 - b. Wait for the kernel to be made. Depending on the hardware configuration, this process can last up to 30 minutes.

Making and Installing the Module

To make and install the module:

1. From the root level, enter:
`make modules`
2. Wait for the modules to be made.
3. After the module is made, install the module:
 - a. From the root directory, enter:
`make modules__install`
 - b. Load the module. Enter:
`insmod multipath`
4. Verify that the module is installed and loaded by listing all modules. Enter:
`lsmod`

The kernel is now ready for multipath operations.

Modifying the RAIDTAB Configuration File

To perform multipath operations with a Linux operating system, a raidtab configuration file must be present. Use the instructions in the following sections to be sure the raidtab configuration file contains the appropriate information.

RAIDTAB Terms

Observe the following definitions for raidtab terms:

- **raiddev**—introduces the configuration for a particular device
- **nr-raid-disks**—the number of raid disks in the array; specified in the /dev/cciss directory
- **persistent-superblock**—must be set to 1 if an md device is to be mounted/used during a reboot
- **chunk-size**—sets the stripe size in bytes, in the power of 2
- **device**—the physical device that makes up the RAID array
- **raid-disk**—the index of the device in the RAID array

For more information, refer to the operating system documentation.

Sample RAIDTAB Configuration File

The following raidtab sample file is for a multipath configuration with three partitions (/dev/md0, /dev/md1, and /dev/md2) where each md device represents a partition on the device. If another partition is needed, add it as /dev/md3 with the same characteristics as the preceding partitions.

The limit for number of partitions is four primary partitions. However, creating one of the four partitions as a type “type 0xf” Win 95 Ext’d (LBA) partition enables you to create extended logical partitions inside of the primary partition. Inside of the extended partition, you can create additional Linux partitions.

The raidtab configuration file must reside in the /etc directory. The contents of /etc/raidtab should resemble the following:

```
raiddev /dev/md0
raid-level          multipath
nr-raid-disks       2
persistent-superblock 1
chunk-size          8
device              /dev/cciss/c0d2p1
raid-disk           0
device              /dev/cciss/c1d2p1
raid-disk           1

raiddev /dev/md1
raid-level          multipath
nr-raid-disks       2
persistent-superblock 1
chunk-size          8
device              /dev/cciss/c0d2p2
raid-disk           0
device              /dev/cciss/c1d2p2
raid-disk           1
```

```
raiddev /dev/md2
raid-level          multipath
nr-raid-disks       2
persistent-superblock 1
chunk-size          8
device              /dev/cciss/c0d2p3
raid-disk           0
device              /dev/cciss/c1d2p3
raid-disk           1
```

Completing the Linux Multipath Setup

After a valid raidtab file is created in the /etc directory, verify that the correct drivers and modules are loaded.

To verify properly loaded files:

1. Verify that the md and multipath drivers are loaded, either statically or by a module load. Enter:

```
lsmod
```

This command reveals which modules are running. Examining the boot-time messages reveals the static loaded drivers.

IMPORTANT: If you have made configuration changes to the kernel (including the multipath or /dev/md driver) and have not rebooted from the new kernel, you must reboot before continuing. Red Hat and SuSE typically include the md driver in the kernel.

2. Verify that the md driver is in the kernel. Enter:

```
dmesg | grep md | more
```

This command shows the boot-time messages. If the md driver was loaded, several messages should appear, similar to the following messages:

```
md: md driver version X.X
md: Autodetecting RAID arrays
md: autorun...
md: ...autorun DONE
```

3. If the multipath driver was built as a module but not loaded, load the module. Enter:

```
insmod multipath
```

This command loads the driver. If the driver does not load the multipath module, rebuild the module. Refer to “Making and Installing the Module” in this chapter.

4. After verifying loaded drivers, make the raid files. For the sample partition table in the “Sample RAIDTAB Configuration File” section, enter:

```
mkraid /dev/md0
mkraid /dev/md1
mkraid /dev/md2
mkraid /dev/md3
```



CAUTION: Do **not** use Fdisk or mkraid to create any other partitions on this logical drive. This action results in data corruption and data loss.

5. If mkraid responds that the partition contains existing data, do the following:
 - a. Force the mkraid to run. Enter:

```
mkraid - f
```

- b. Make filesystems on the raid devices. Enter:

```
mkfs -t ext2 /dev/md0
mkfs -t ext2 /dev/md1
mkfs -t ext2 /dev/md2
mkfs -t ext2 /dev/md3
mkfs -t ext2 /dev/md4
```

IMPORTANT: The example in step 5b uses `ext2` because known bugs in the `ext3` filesystem can cause data corruption.

6. The multipath RAID device should be functioning. To mount the device `/dev/md0`, enter:

```
mount /dev/md0 /spare_filesystem
```

If necessary, you can stop or start the RAID device with the following commands:

- To stop the RAID device, enter:

```
raidstop /dev/md0
```

This command may need to start the md device after a reboot. Place the command in the `rc /etc` configuration files for mounted filesystems at boot time.

- To start the RAID device, enter:

```
raidstart /dev/md0
```

This command can be placed in shutdown scripts in `/etc`.

For more information, refer to the operating system documentation.

Installation and Operation

Preparing for Software Installation

To prepare for software installation:

1. Complete the MSA500 system hardware installation:
 - a. Install the MSA500 system.
 - b. Install the 4-Port Shared Storage Module.
 - c. Install the controllers.
 - d. Update the system firmware, if needed.
2. Complete the server installation:
 - a. Install all hardware, including a second supported HBA

IMPORTANT: For Microsoft operating system installation, the server only supports one SCSI path during installation. If the server is already cabled for a multipath configuration, disconnect the SCSI cable connected from the redundant HBA to the storage system.

- b. Install a supported operating system.
 - c. Reboot the server.
3. Install a multipath cabling configuration. Refer to “Supported Four-Node Configurations” in Chapter 1.

4. Depending on the operating system, do one of the following:
 - If the server has a Microsoft operating system, be sure that only one SCSI cable is connected from the server to the MSA500 system. During installation, the Smart Array Multipath software supports only one SCSI path per Microsoft-based server.
 - If the server has a Red Hat or SuSE Linux operating system, edit the active kernel and modify the RAIDTAB configuration. Refer to “Additional Red Hat and SuSE Linux Preparations” in Chapter 1.
5. Power up the storage system. Wait for the controller display to provide a “Startup Complete” message.
6. Power up one of the servers.

Installing the Smart Array Multipath Software

Upgrade Procedures for Microsoft Operating Systems

Use the appropriate procedure in this section when upgrading the multipath software or your Microsoft operating system.

IMPORTANT: Systems running Microsoft Windows 2000 with Service Pack 4 or Windows Server 2003 must use Smart Array Multipath Software v2.0 or later.

Upgrading to Windows 2000 Service Pack 4 or Later

1. Uninstall Smart Array Multipath software v1.0, if installed. Refer to “Uninstalling the Smart Array Multipath Software Driver” in this chapter.
2. Install the service pack.
3. Install Smart Array Multipath software v2.0 or later. Refer to “First-Time Installation” in this chapter.

Upgrading to Microsoft Windows Server 2003

To upgrade your operating system to Microsoft Windows Server 2003:

1. Uninstall Smart Array Multipath software, if installed. Refer to “Uninstalling Smart Array Multipath Software Driver” in this chapter.
2. Upgrade to Windows Server 2003.
3. Install Smart Array Multipath software v2.0 or later. Refer to “First-Time Installation” in this chapter.

Upgrading from v1.0 to v2.0

1. Uninstall Smart Array Multipath software v1.0. Refer to “Uninstalling Smart Array Multipath Software Driver” in this chapter.
2. Install Smart Array Multipath software v2.0 or later. Refer to “First-Time Installation” in this chapter.

Uninstalling Smart Array Multipath Software Driver

To uninstall the software:



CAUTION: Before uninstalling the software driver in a Microsoft Windows Server 2003 clustering environment, use the Cluster Administrator to stop the cluster service on the appropriate node.

1. Power down the server.
2. Disconnect all SCSI cables from any Smart Array 532 Controllers in the system, unless the boot drive is attached.
3. Power up the server.
4. Select **Start>Settings>Control Panel**.
5. Select **Add/Remove Programs**.
6. From the list of components, select **Compaq Smart Array Redundancy Filter Driver**.

NOTE: For Microsoft Windows Server 2003 only, the selection is **Compaq Smart Array Multipath Driver**.

7. Click **Change/Remove**.

8. Click **OK**.

NOTE: A Microsoft Windows Server 2003 system does not indicate progress during the removal. Wait at least 10 minutes to allow the system to complete the removal.

9. Click **Cancel**.
10. Shut down the server.
11. Disconnect the SCSI cable from the redundant HBA.

First-Time Installation

1. To install the Smart Array Multipath software, refer to the *HP Smart Array Multipath Software CD Installation Instructions* that ship with the CD.
2. After completing the installation instructions, depending on the operating system, do one of the following:
 - If the server has a Microsoft operating system, go to step 3.
 - If the server has a Linux operating system, go to step 4.
3. For a Microsoft operating system:
 - a. Reconnect the SCSI cable from the redundant HBA to the MSA500 system.
 - b. Cycle the server power.
4. Repeat steps 1 through 3 for subsequent servers.
5. Use the appropriate software for specific Microsoft or Linux multipath operations:
 - For Microsoft operating systems, refer to “Static LUN Balancing” in this chapter.
 - For Red Hat or SuSE Linux operating systems, refer to “Static Load (Read-Only) Balancing” in this chapter.
 - For the UnitedLinux operating system, refer to “UnitedLinux Configuration” in this chapter.

UnitedLinux Configuration

After installing Smart Array Multipath software on a server with a UnitedLinux operating system, configure for multipath operations.

Review the following sample configuration procedure. This sample assumes that the user wants to set `/dev/cciss/c1d0p2` and `/dev/cciss/c2d0p2` to point to the same volume as a multipath device.

To configure the system for multipath use:

1. Be sure that the MSA500 system contains two controllers connected to the same logical volume.
2. To create multipath device `/dev/md0`, run:

```
mdadm -create -level multipath -n 2 /dev/md0  
/dev/cciss/c1d0p2 /dev/cciss/c2d0p2
```

3. To review the status, run:

```
mdadm -D /dev/md0
```

Results should look similar to the following:

`/dev/mdp:`

Version : 00.90.00

Creation Time : Mon Apr 29 09:15:00 2003

Raid Level : multipath

Array Size : 14683328 (14.00 GiB 15.08 GB)

Raid Devices : 2

Total Devices : 2

Preferred Minor : 0

Persistence : Superblock is persistent

Update Time : Mon Apr 29 09:02:00 2003

State : dirty, no-errors

Active Devices : 2

Working Devices : 2

Failed Devices : 0

Spare Devices : 0

Number	Major	Minor	RaidDevice	State
0 106	2	0	active sync	/dev/cciss/c2d0p2
1 105	2	1	active sync	/dev/cciss/c1d0p2

UUID : b1ec5895:5ed49b44:7ec7d4a8:397e19b1

IMPORTANT: You can also review status by running:

```
/proc/mdstat
```

Results would look similar to the following:

Personalities : [multipath]

read_ahead 1024 sectors

md0 : active multipath cciss/c2d0p2[0] cciss/c1d0p2[1]

14683328 blocks [2/2] [UU]

unused devices : <none>

4. To format the volume, run:

```
mkfs -t ext2 /dev/md0
```

5. To mount the volume, run:

```
mount /dev/md0/spare_filesystem
```

6. Configuration is complete. To perform multipath operations, refer to “Static Load (Read-Only) Balancing” in this chapter.

Multipath Operations

Microsoft Browser Security Settings

For Windows Server 2003, the modified version of Internet Explorer 6.0 defaults all servers to the “Internet zone,” which enables the highest level of security. At this security level, browsing to HP Management agents generates many security messages.

To avoid these security messages:

1. Open Internet Explorer 6.0.
2. Select **Tools>Internet Options**.
3. Select the **Security** tab.
4. Click **Local intranet**.
5. Manually set the servers to the Local intranet zone by entering:
`http://<servername or IP address>:2301`
`https://<servername or IP address>:2381`

Static LUN Balancing

The Smart Array Multipath software and Microsoft operating system support static LUN balancing. The movement of drives to specific paths can be done two ways:

- Locally with a Device Manager Extension (DME)
- Remotely with the Smart Array Multipath found on the Smart Array Multipath Software CD

To balance LUNs with the DME:

1. From the desktop, right-click **My Computer**.
2. Click **Manage**. The **Device Manager** window opens.
3. Click **SCSI and RAID Controllers**.

4. Right-click one of the array controller icons and click **Properties**.
5. When the **Properties** window opens, click the **Redundancy Configuration** tab.

From the **Redundancy Configuration** tab, the administrator can view the following controller information:

- Name
 - Slot number
 - Status
 - Slot number of redundant controller
 - Controller tree
6. In the controller tree, right-click one of the logical volumes and then click **Switch Path**. The system moves the logical volume to the other path.

To manage your redundant configuration:

1. First-time users must install the software. Install the ProLiant Storage Manager software and Smart Array Multipath Manager software. Refer to the *Smart Array Multipath Software CD Installation Instructions*.
2. Browse to the **System Management Homepage** by entering:

```
https:\\<name of server>:2381
```

IMPORTANT: If you encounter numerous security messages on a Windows Server 2003 platform, refer to “Microsoft Browser Security Settings” in this chapter.

3. To accept the security certificate, click **Yes**. The system may prompt for the administrator password established during the original software installation. The **System Management Homepage** opens.
4. Click the **Home** tab.
5. Select **ProLiant Storage Manager**. A new window opens.
6. Click the appropriate controller on the **Device View** tab.
7. Click **Multipath Management**. The **Multipath Management and Configuration** screen displays.

8. From the **Multipath Management and Configuration** screen, do one of the following:
 - To move all drives from the current path to the redundant path, click the link for the controller and select **Switch All Paths**. The system moves all drives to the redundant path.
 - To move a drive from one path to the redundant path, click the link for the drive and select **Switch Path**.

IMPORTANT: After establishing a redundant configuration and adding a logical volume, use Windows Disk Manager to detect the new volume.

Static Load (Read-Only) Balancing

The Smart Array Multipath software and Linux operating system support static load (read-only) balancing functionality. To create, add, or extend logical volumes, use ACU Version 6.0 or later. Locate ACU on the SmartStart CD. Refer to the *HP Array Configuration Utility User Guide* on the SmartStart CD or refer to the HP website:

www.hp.com

Problem Diagnosis

When a problem exists with the multipath I/O, consult the Insight Management Agents and do one of the following:

- For Microsoft operating systems:
 - Use the ProLiant Storage Manager FAQs
 - Use the ProLiant Storage Manager software and the Device Manager Extension to identify I/O path status.
- For Linux operating systems, use the following command to identify HBA status, multipath status, and I/O block transfer size:

```
cat /proc/mdstatus
```

Problems During Installation

This section provides systematic instructions on what to try and where to go for help for the most common problems encountered during software installation.

If you encounter problems during installation:

1. In a Microsoft environment, be sure to uninstall any previous version of the multipath software first. Refer to “Upgrade Procedures for Microsoft Operating Systems” in Chapter 2, “Installation and Operation.”
2. Be sure that the firmware is upgraded for all of the HBAs and both of the HP StorageWorks Modular Smart Array 500 controllers, if installed.

3. Be sure that the hardware installation meets the minimum requirements for the software. Refer to “Minimum Requirements” in Chapter 1, “System Preparation.”
4. Be sure that the SCSI cabling configuration is complete. Refer to “Supported Four-Node Configurations” in Chapter 1, “System Preparation.”
5. Be sure that the HBA is functioning properly. Refer to the appropriate server and HBA documentation. If the HBA has failed, refer to “HBA Failure” in this chapter.
6. Be sure that the SCSI cable is functioning properly. If the cable has failed, refer to “Cable Failure” in this chapter.
7. Be sure that you followed operating system-specific instructions:
 - If the server has a Red Hat or SuSE Linux operating system, be sure that the active kernel is edited properly.
 - If the server has a Microsoft operating system, be sure that the SCSI cable from the redundant HBA was disconnected before Smart Array Multipath software installation.

IMPORTANT: After establishing a redundant configuration and adding a logical volume, use Windows Disk Manager to detect the new volume.

8. If these steps do not solve the installation problem, contact an authorized reseller.

HBA Failure

If one of the HBAs in the server fails, the redundant HBA performs all I/O operations.

To replace the failed HBA:

1. Power down the HBA in one of the following ways:
 - For a PCI-based HBA in a Microsoft operating system environment, use the PCI Hot Plug functionality in the server to power down the HBA while the server is online.
 - For an embedded HBA in a Microsoft operating system environment, power down the server.
 - For an HBA in a Linux operating system environment, power down the server.
2. Disconnect the SCSI cable from the connector on the HBA or from the external VHDCI connector on the server.
3. Remove the failed HBA. Refer to the server maintenance and service guide.
4. Install a replacement HBA. Refer to the documentation that ships with the server or HBA.
5. Connect the SCSI cable to the connector on the HBA or to the external VHDCI connector on the server.
6. Power up the replacement HBA in one of the following ways:
 - Use PCI Hot Plug functionality to restore power.
 - Power up the server.

IMPORTANT: In a Microsoft environment, the software recognizes the replacement HBA and automatically restores redundancy.

7. If operating in a Linux environment, reconfigure the I/O for multipath operation. Refer to Chapter 2, “Installation and Operation.”

Cable Failure

To replace the failed cable:

1. Power down the HBA in one of the following ways:
 - For a PCI-based HBA in a Microsoft operating system environment, use the PCI Hot Plug functionality in the server to remove the HBA while the server is online.
 - For an embedded HBA in a Microsoft operating system environment, power down the server.
 - For an HBA in a Linux operating system environment, power down the server.
2. Disconnect the SCSI cable:
 - a. Disconnect the cable from the MSA500 system.
 - b. Disconnect the cable from the connector on the HBA or from the external VHDCI connector on the server.
3. Connect the replacement cable:
 - a. Connect the cable to the connector on the HBA or to the external VHDCI connector on the server.
 - b. Connect the cable to the MSA500 system.
4. Apply power to the replacement HBA in one of the following ways:
 - Use PCI Hot Plug functionality to restore power (PCI-based Microsoft Only).
 - Power up the server.

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